

Science & Industry Museum - Manchester 1830 Station Building – Roofing Works

Section 5 - Proposed Mechanical & Electrical Scope of
Works & Particular Specification

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Rev P1

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Amendment Record Sheet

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5.0 Section 5 –M&E in Connection with Roofing Works

5.1 Introduction

This document is intended to provide the technical performance proposals for the mechanical engineering services design and installation in connection with the roofing works of the 1830 Station Building at the Science & Industry Museum in Manchester.

The project has been developed based on information provided by Buttress Architects. This section of the project information is to be read in conjunction with all other sections of the specification and design drawings.

The general works will be carried out in a single phase.

It is proposed that all existing services and equipment that become redundant shall be stripped out in their entirety and removed from site.

This report provides information for the requirements and proposals for the detailed design, supply, delivery, off-loading, isolation and strip out of redundant systems and equipment, installation and services co-ordination, testing, commissioning, handing over on completion in a satisfactory working order and correction of defects during the defects liability period of all systems, items, parts and apparatus specified and described in these documents, schedules and drawings.

This information is provided for guidance only and is subject to verification by the Contractor during the detailed design process.

All final design information shall be provided as requested by the Project Manager for checking/comment. As a minimum this shall include the following-

- Fully Coordinated Detailed Design Packages
- M&E Services Installation and Record Drawings
- Technical Submissions for all Plant and Equipment
- Commissioning Method Statements
- Handover Documentation
- All Test Sheets

All work shall conform to the principles of modern practice and shall be carried out by competent tradesmen of the appropriate Construction trades.

and testing of any part of the electrical plant and / or items of equipment, included in this contract.

5.1.1 Project Location

The address of the proposed works is as follows:

1830 Station Building
Science & Industry Museum
Liverpool Road
Manchester
M3 4FP

5.1.2 Standards

The complete services installation and components shall, unless stated otherwise, comply with the appropriate British Standard (BS and/or BS EN) or Code of Practice (CP) and where no BS or CP is applicable the Agreement Certificate for the particular item.

All equipment and systems shall be designed and installed in accordance with the relevant standards, manufacturers recommendations and that operational compatibility exists between the systems and any other system installed in the same location.

All equipment, materials and workmanship shall meet the requirements of, but not be limited to the following documents and standards unless otherwise indicated in this specification: -

- a) Conditions of Contract
- b) Other Standards: -
 - Guides to Good Practice as published by the Chartered Institution of Building Services Engineers. (CIBSE).
 - Latest edition of British Standard Specifications and British Standard Codes of Practice
 - Building Control & Conservation Officer Requirements.
 - Planning Requirements.
 - The Local Fire Officer's Requirements.
 - The Health and Safety at Work Inspectorate's Requirements.
 - BS 7671: Requirements for Electrical Installations.
 - IET Wiring Regulations.
 - Building and Engineering Services Association (Formerly HVCA) Ductwork Specification Standards DW 144, 145 and 172.
 - BSEN 12056: 2000 Parts 1-5 Gravity Drainage Systems Inside Building.
 - Construction (Design and Management) Regulations 2015.

All other standards specifically noted within the Technical Sections of this specification.

Standard workmanship clauses are detailed in preceding sections of this specification.

Although the above document list does not intend to be exhaustive, it is intended to give the Contractor an indication of the likely related standards and regulations applicable to a scheme of this nature.

5.1.3 Consultants Responsibility

The consultant shall be responsible for the identification, clarification and production of detailed tender documentation necessary to enable the Mechanical and Electrical Contractor to provide a complete tender return package for the project.

5.1.4 Contractors Responsibility

The Contractors responsibility in relation to proposed project are as detailed below. The Contractor shall include to undertake all the duties identified below.

Detailed design, supply and installation of complete and functional mechanical & electrical services installations, adhering to the Standard and Particular specifications and drawings, incorporating any necessary changes to the installation due to final site co-ordination.

Complete the installation in order to ensure that the contract services are properly and fully co-ordinated with the building fabric and structure to the client's satisfaction.

Provide all working drawing information, prior to ordering and installation of equipment.

Include for all working drawings and any co-ordination deemed necessary due to satisfy the constraints of the structure, finishes and other services.

Co-ordination and preparation of the appropriate working drawings shall be carried out in accordance with an agreed contract programme.

The supply, delivery, off-loading, storage, installation, testing and commissioning of the installations.

Demonstration of operation of all systems to the clients chosen representative.

Attendance at all co-ordination meetings with other sub-Contractors arranged by the main Contractor and agree co-ordination, not only relating to the sequence of operation but also to the preparation of working drawings which will fully reflect the agreed scheme.

Liasion with all necessary sub-Contractors and others, including statutory authorities as necessary to ensure co-ordination of the works in relation to building elements and services.

Installation of all services in such a manner so as to ensure correct performance and adequate fixing to the structure to avoid conflict in the positioning of the various mechanical and electrical services installed by others.

Fixing and installing correctly all proposed plant, equipment and materials according to the manufacturer's requirements.

Inspection of all plant, equipment and materials as delivered or where specified at the manufacturers works.

Demonstration that the overall and complete systems perform correctly in the required manner and as intended by the specifications and drawings to the satisfaction and acceptance of the Engineer.

Provide record drawings for the completed installation.

Provide of 1 No. bound Operating and Maintenance manual for the completed installation.

Provide of a full set of test results in an approved format for all tests and commissioning operations to the satisfaction of the Engineer.

The Contractor shall include for any exclusions identified by the specialised sub-contractors.

The Contractor shall include for all diversions and isolation works.

The contractor shall visit site prior to submitting his costs for the works.

The contractor is advised that the building is a Grade II listed building and that high levels of workmanship and co-ordination are required and works shall be carried out in full accordance with any conditions of the Listed Building Consent.

The Contractor shall assess all new plant and equipment locations and service routes ensuring that these are adequate for the proposed works.

5.1.5 Standards of Workmanship

The workmanship and materials of the installation shall be of the highest standard in accordance with this specification and associated documents, which shall be to the complete satisfaction of the Clients representative. Should any section of work or materials fail to meet the required standard, it shall be replaced by the Contractor at no extra cost to the contract.

5.1.6 Construction Design & Management Regulations 2015

The works will be carried out under the Construction Design & Management Regulations 2015, and shall make all necessary allowances as required under the said regulations.

5.1.7 Co-ordination of Services

The Contractor shall ensure that the routing of ducts, pipework controls wiring containment and positioning of items of equipment do not obstruct or prevent the effective operation and maintenance (either planned preventative or corrective) of any items of equipment installed, including installations by others. Claims for extras due to lack of liaison and/or co-ordination between trades will not be considered.

Due to the nature of the building, existing, old and refurbishment – the service routes indicated on the drawings are produced for parity. The contractor shall make due allowances for on-site modification to those routes indicated and coordination with other trades to provide a full working installation installed to the satisfaction of the client and project manager.

5.1.8 Builders Work Details

The contractor shall be responsible for the design of all ducts and builders work requirements and provision of all necessary bracketing for support of installed equipment.

Any builders work drawings are to be produced by the Contractor and approved by the project manager.

5.1.9 Technical Queries

Should any doubt exist to the interpretation of this specification and extent of work covered hereby, any technical queries should be addressed to:-

James Allister
Silcock Leedham Consulting Engineers
Upper Bank House,
Stoneythorpe
Horsforth,
Leeds,
LS18 4BN

5.1.10 Site Waste Management

The Contractor shall comply with the Site Waste Management Plan and ensure that all removed, surplus and redundant materials are correctly segregated into material type, temporarily stored on site and arrange for its collection by an appropriate Licensed Waste Disposal Company.

5.1.11 Handover & Completion

The Contractor to include for applicable elements of the delivery, commissioning and handover procedures as outlined in the main contract documentation in addition to the requirements of this specification.

5.1.12 Programme & Phased Works

The Contractor shall familiarise themselves with the proposed Construction Programme and any works area phasing plan provided by the Project Manager and Architect, and take in to consideration any phased work areas and handover dates of the project.

5.2 Outline Description of Works

The proposed scope of Mechanical & Electrical works to be included for by the contractor includes the supply, delivery to site, off-loading, positioning, installation, setting to work, testing and commissioning of the complete Mechanical & Electrical Engineering systems to the development which is to be completed to the satisfaction of the Client, Architect and Engineer.

The proposed scope of works will include, but not be limited to the following:

- a) The detailed design development of the engineering services to comply with the employer's requirements.
- b) The production of fully coordinated working drawings for all services, making allowances for final architectural, structural information.
- c) The strip out and removal of all existing systems that become redundant as part of these works including ventilation ductwork and weatherproof terminal which is to be removed and replaced with new as part of the works.
- d) The design, supply, installation, testing and commissioning of a new Hutton+Rostron "Curator" gutter flood detection and alarm system utilising sensors located at gutter drain outlets, local controllers, radio frequency transmitters, receiving base stations, front end PC terminal loaded with specialist monitoring and alarm raising software.
- e) The design, supply, installation, testing and commissioning of a new snow and ice melting electric trace heating system to gutters and rainwater down pipes as identified on the tender drawings inclusive of central control panel, self-regulating trace heating cabling, junctions, sensors, cable cut end stops etc to provide a complete and working installation.
- f) The design, supply, installation, testing and commissioning of new electrical distribution and power supplies to service the new floor detection and trace heating systems.
- g) The supply of desktop study and risk assessment with a report on the likelihood of lightning strike to the 1830's Station building.
- h) The design, supply, installation, testing and commissioning of new Lightning protection system
- i) Liaison with other service providers and Contractors employed on the project to ensure that a fully coordinated installation is provided. Ensure that the routing of services, conduit, cabling, controls wiring containment and positioning of items of equipment do not obstruct or prevent the effective operation and maintenance (either planned preventative or corrective) of any items of equipment installed, including installations by others.
- j) The provision of all builders works drawings to the architect and structural engineers for approval prior to undertaking the works on site.
- k) The provision of all builders works associated with the above services installations including, making good, fire stopping, access gantries, secondary support steelwork, access platforms, etc.
- l) The provision of installation and working drawings which show the complete mechanical and electrical requirements for the project. These drawings shall be completed to include the following for each installation: -
 - Electrical Distribution & Small Power Drawings

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- Electric Trace Heating Drawings & Schedule of Equipment
 - Lightning Protection Drawings
 - Flood Detection & Alarm Systems Drawing & Schedule of Equipment
- m) In addition to the above drawings, provide copies of all specifications, plant and equipment schedules proposed to the Contract Administrator for comment. For further details relating to the comments / approval process refer to the Main Contract and Standard Specification.
- n) The provision of all supplementary design and construction information for the successful completion of the project including but not limited to;
- Electrical power loads and control wiring information
 - Size and weight of plant and equipment
 - Health and Safety documentation
- o) All testing and commissioning of all services installed altered and extended under this contract
- p) The provision of 'as fitted drawings', operation and maintenance manuals

5.3 Ducted Penetrations in Roof Structure

The proposed works to replace the roof covering and guttering systems have a minor effect on the existing building services systems.

There is one penetration of the roof construction in connection with existing building services systems which consists of a pair of steel ventilation ducts connected to a fresh air input system

It is proposed that the ventilation cowl be replaced with new on a like for like basis. The replacement cowls will be manufactured from galvanised sheet steel and shall be complete with weatherproof inlets and wire mesh endcaps to protect against birds.

The contractor shall include for a new weatherproofed upstand and weatherproof flashings shall be provided.

5.4 Gutter Flood Monitoring & Alarm System.

It is proposed to install a flood detection system to the new guttering system at the rainwater downpipe outflow positions.

The contractor shall include for the supply design, installation, testing & commissioning of a specialist gutter monitoring and alarm system.

It is proposed that this element of the works shall be carried out by building fabric conservation specialists Hutton+Rostron utilising their Curator™ system.

Hutton+Rostron contact details are as follow:

Andy Wade

Hutton+Rostron Environmental Investigations Ltd
Netley House, Gomshall,
Guildford,
Surrey GU5 9QA
Tel: 01483 203 221
Email: andy@handr.co.uk

The Curator system provides an early warning and raises an alarm in the event of a blocked gutter or downpipe system. The monitoring and alarm system comprises of a local flood sensor located in the rainwater guttering system. The sensor is hard wired to a local controller which is paired to a local radio frequency transmitter which reports back to a base station and dedicated PC. The sensor is not affected by normal rainfall and is only triggered when it becomes completely submersed by the failure of the roof drainage system. When the sensor is triggered the base station picks up an alarm signal from the sensor controller and communicates with the desktop PC which is able to send an alert via SMS or email via a permanent internet connection.

The proposed system will be installed to monitor 6 No. rainwater outlets, as identified on the tender drawings.

The system shall comprise of:

- Flood Sensors
- RF Transmitter
- RF Receiver Base station
- Hard Wired Network Cable

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- Desktop PC with Curator Software

The contractor shall include for all preliminary costs associated with Hutton+Rostron's site survey and project preparation.

Hutton+Rostron shall commission and set up the system and provide the client with a demonstration and a written overview of the installation at completion of the works.

The contractor shall coordinate the Hutton+Rostron works with the roof replacement works and his works programme and shall include for all liaison required to complete the works.

5.5 Electric Trace Heating Installation

It is proposed to install an electric trace heating snow and ice melting system to protect the new guttering system and rainwater downpipe drainage system.

The contractor shall include for the supply design, installation, testing & commissioning of a specialist gutter and downpipe electric self-regulation trace heating system to protect from snow and ice build-up to the areas of the roof identified on the tender drawings.

It is proposed that this element of the works shall be carried out by a specialist supplier and installer who shall be responsible for the design, supply, installation, testing and commissioning of the installation. The specialist shall be:

nVent Raychem

David Perry
nVent - Raychem
3 Rutherford Road
Stephenson Industrial Estate
Washington
Tyne & Wear NE37 3HX
Tel: 07836 236 534 Mobile

Email: David.perry@nVent.com

The contractor shall include for all preliminary costs associated with nVent- Raychem site survey and project preparation.

nVent - Raychem shall commission and set up the system and provide the client with a demonstration and a written overview of the installation at completion of the works.

The contractor shall coordinate the nVent - Raychem works with the roof replacement works and his works programme and shall include for all liaison required to complete the works.

The system shall be based around the Ice Stop GM-2X self-regulating heating cable system inclusive of self-regulating heating cable, cable spacers, end seals, junctions, power connection points, SBS-##-EV-10 control panel.

The design should be carried out in accordance with IEC standards IEC 62395 parts 1&2.

All down pipe protection cables should extend 1m into the below ground systems.

5.6 Electrical Services Installations

Protection Systems – Electrical Installations

The contractor shall include for the supply design, installation, testing & commissioning electrical services infrastructure required to service the new trace heating and flood detection systems provided by Hutton+Rostron and the nVent – Raychem trace heating installation.

Gutter watch & snow melting systems will need new local power supplies to trace heating control panels, system user interfaces, transmitters and RF base station receivers in accordance with the specialist supplier / contractors' details.

The contractor shall include for the design supply and installation of a new Schneider Acti-9 type B, 8-way TP distribution board located in room SB 103B as indicated on the scheme drawings. The new distribution board shall be supplied via a new dedicated sub-main from existing basement level electrical switchgear room SB LG05B, on a 63Amp, 3 phase sub main circuit wired in black XLPE/SWA/LSF 4 core armoured cable. Cable route shall follow existing riser provision and be clipped direct and must be agreed on site with the project Architect.

All new final circuit power supplies are to be radial circuits fed from the new distribution board electrical infrastructure via copper singles in black enamelled surface mounted conduit installations or Protec BS 8436 black sheathed cables following existing containment systems and surface clipped with screwed P-clips as approved by the project Architect.

All accessories are to be MK metal-clad when indoors or suitably IP rated accessories in exposed locations.

All circuits are to be minimum 2.5mm² cable with 16Amp RCBO or MCB/RCD protection.

Existing Installations

All redundant electrical services and equipment within the works area and on the parapet wall/roof to be safely isolated and removed as part of the project scope of works.

The contractor shall include for a detailed survey prior to the start of the works to identify all existing electrical services attached to the roof structure which shall be need to be either temporarily isolated, removed and re-instated at the end of the works and existing installations that require physical protection during the roof replacement works phase including protection from the elements, dust, dirt, direct mechanical / physical damage and excessive vibration causing movement, damage or collapse.

The contractor shall assess the existing services and make due allowance for protection, temporary removal or diversion to maintain system quality, condition and integrity.

Works potentially affected include lighting installations, fire alarm installations and the like which should all be left safe and operational and as found at completion of the re-roofing works. In addition, all roof aerial cabling and data cabling to be temporarily removed or renewed to allow works to be completed and reinstalled by being securely clipped to the inside of the parapet wall via PVC coated P-clips and brass screws.

All electrical installations both new and any altered or amended existing installations shall be fully tested and commissioned at completion with signed certificates provided. All electrical installations to comply in full with BS 7671.

5.7 Lightning Protection System

The 1830 Station Building has no existing lightning protection installation.

For complete protection of the structure it is proposed that a desk top study should be carried out to risk assess the likelihood of a building strike and assess the extent of protection provided by surrounding buildings.

The contractor shall include a lightning protection risk assessment to be carried by a lightning specialist in accordance with BS EN 62305 – Protection Against Lightning.

The contractor shall also provide costs for the design, supply, install, test and commissioning of a Lightning Protection and Surge Protection System for the building.

The contractor shall liaise with their own nominated specialist to develop a scheme which is both compliant and sympathetic to the building structure and listing. Any new lightning protection system shall be sympathetic to the buildings appearance, structure and finishes and be installed in accordance with the conservation Architect's and local authority approval.

The proposed scope of works for lightning protection system shall include:

The lightning protection network provided shall be in accordance with this Performance Specification and in full compliance with the latest edition of BSEN 62305:2011 and other applicable British Standards and Codes of Practice.

The lightning Protection shall be installed to reduce the risk of damage to the building, or harm to occupants through lightning strikes by safely directing the lightning discharges to the general mass of earth and to protect electronic equipment from the harmful effects of induced voltage surges.

Full supportive calculations must be provided by the contractor and issued to the client representative for comment prior to installation.

The contractor shall provide a complete Lightning Protection system utilising roof mounted copper tape as an air termination network and circular down conductors which shall terminate at earth pits comprising inspection pits complete with covers and earth electrodes or plates if ground conditions do not permit the utilisation of earth electrodes. All vertical drop positions shall be agreed with the Architect. All tapes must be concealed where practicable using downspouts and other Architectural features.

Testing shall be by disconnection of the down conductor from the earth electrode/plate at suitable locations. Every down conductor pipe is to be provided with a test link.

The Lightning Protection System shall be connected to the main earthing bar in the electrical switch room.

The contractor shall provide full plan drawings of the proposed Lightning Protection System together with earth pit details and all above and below ground connection details including locations of cross bonding connections to building elements. All drawings shall be issued for client approval prior to installation. The contractor shall provide a CDM Method Statement with the drawing(s) for the installation of the Lightning Protection System.